

Session 1 Introduction to QGIS and Raster Imagery

Data Requirements

For this exercise you will need:

All files from the “Week1_Data” zipped folder on the ARSET website including:

- CA_projected.shp
- CA_Cities_Top10.shp
- Yosemite_boundary.shp

You can download all the data files listed above on the ARSET website:

<https://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index>

You will need to unzip this folder and save it to a folder on your computer. It is recommended that all data for this webinar be well organized and remain in the same location.

Introduction

This exercise will provide you with a brief overview of QGIS elements. It will also show you how to add vector data and modify layer attributes. Additionally, raster data (Landsat imagery) will be acquired and input into QGIS.

Homework

In order to complete the homework, you should complete all of the steps outlined in this exercise. Use the homework link below or on the ARSET website to complete the Google Form. Some of the homework questions will come from the lecture, and some will come from completing this exercise.

Homework Link:

https://docs.google.com/forms/d/1P_Hv2Znw2tG3xJ5vXRdTXsd8ndxdPUnyNbD4goOdL78/viewform

Prerequisites and Additional Informational Websites

QGIS and associated plugins should already be downloaded as part of the prerequisites for this course. See the *Downloading and Installing QGIS.docx* on the ARSET website. This introduction assumes that you have a basic background with geospatial software. If you are not familiar with any geospatial software we suggest spending some time exploring QGIS prior to the webinar. Additionally, QGIS has very useful user tutorials located here:

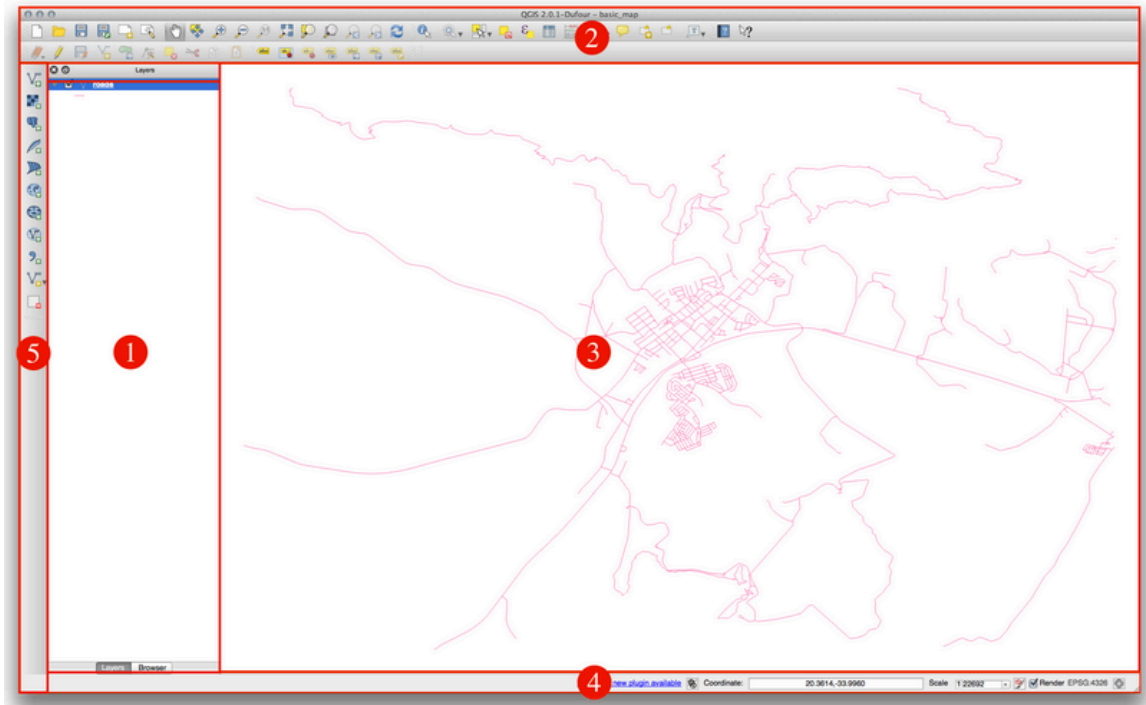
http://docs.qgis.org/2.8/en/docs/training_manual/index.html.

Part 1: Getting Started with QGIS

- Open QGIS

For Mac users: from your Desktop icon or your Applications folder. For Windows users: from your Desktop icon or your Program start.

The QGIS interface has multiple elements outlined here:



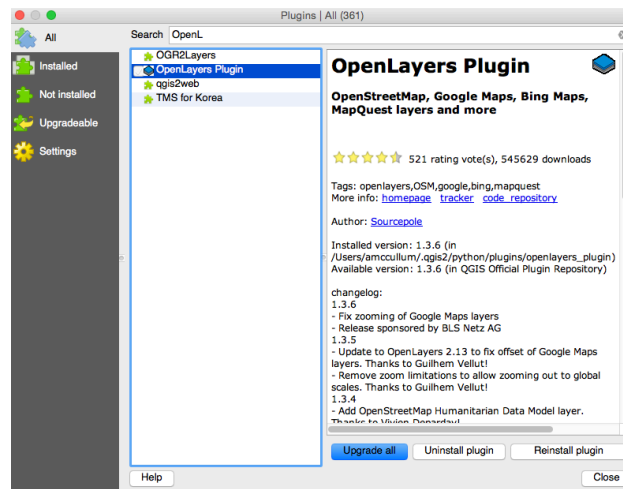
- Take a look at each of the elements:
 - 1. Layers List/Browser Panel**
 - a. This will display all the layers you have in the map. You can right click on each layer file for more information and to perform specific functions. You can also expand and collapse items within the panel.
 - 2. Toolbars**
 - a. The tools you use most often can be displayed here. You can modify which tools are displayed by click on on "View"---> "Toolbars". You can also move tools around within this toolbar.
 - 3. Map Canvas** (where map is displayed)
 - 4. Status Bar**
 - a. This shows current information about the map and allows you to adjust the scale.

- Here you can add in different types of data layers. Note: if you hover over any of these icons, it will display the function name. Explore the available functions.

Part 2: QGIS Plugins

Plugins are optional tools that you can import into your QGIS for additional functionality. A useful plugin for QGIS is OpenLayers and includes Google Maps, OpenStreetmap and Yahoo Map layers.


- From the Plugins menu in QGIS, choose **Manage and Install Plugins** enter Openlayers in the search field and select **OpenLayers Plugin** from the list.

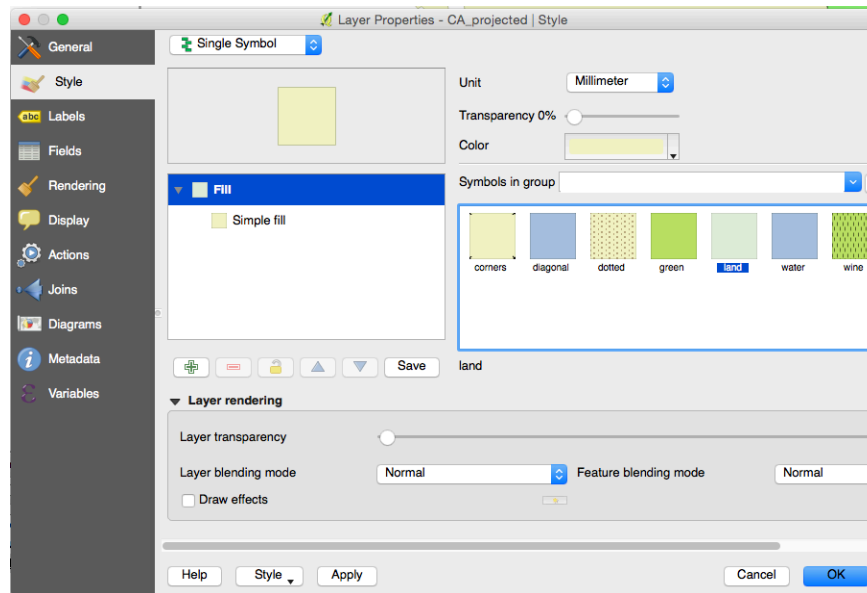


- Click the **Install plugin** button. This will download the plugin from the repository, install it, and load it into QGIS.
- Install the **Semi Automatic Classification Plugin**. This is a useful plugin for many types of raster operations such as classifications.
- Another useful plugin is **GRASS** (Geographic Resources Analysis Support System) and can be used through QGIS. GRASS allows for additional abilities to view, edit and create data as well as perform analysis. GRASS 6 plugin is automatically installed as a plugin with the initial download of QGIS 2.0.
- Feel free to explore additional plugins!

Part 3: Adding and Modifying Vector Layers

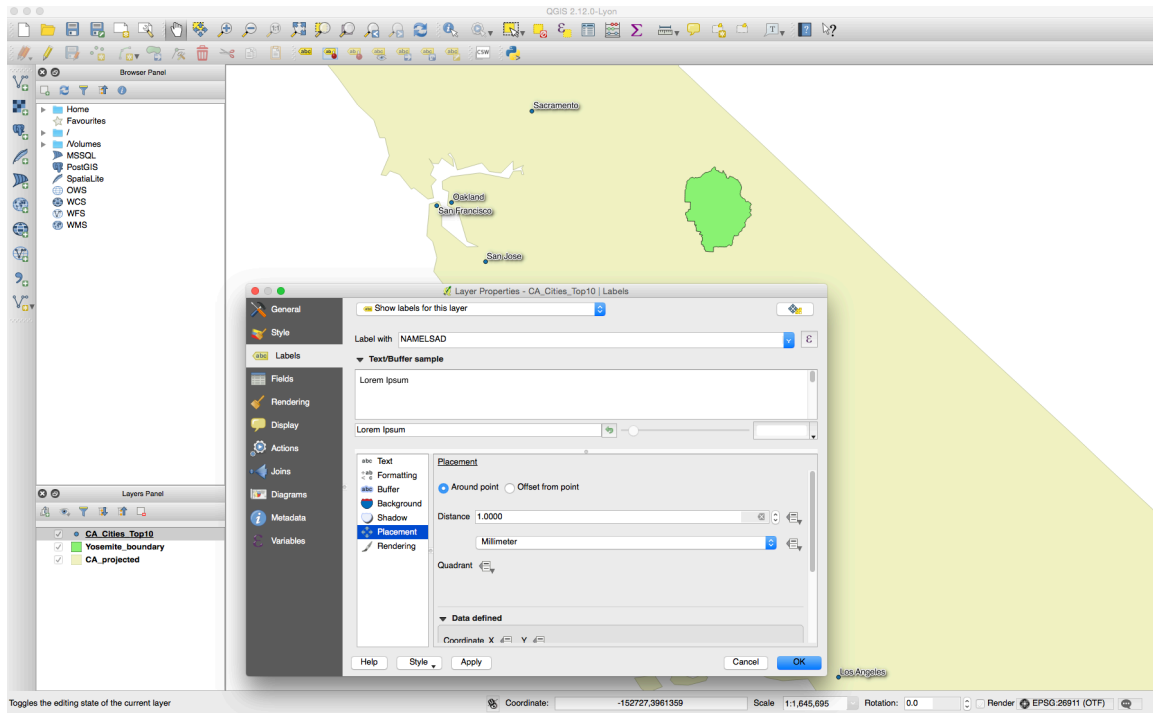
Adding a vector layer

- Click on the **Add Vector Layer** icon 
- Next to Dataset click on the **Browse** button and find the shapefile called CA_projected.shp. Click **Open** to add it to the map. The layer will be added to the map and you should see an outline of the state of California. The color may not be aesthetically pleasing, so we can change that.
- Right click on the CA_projected file in the Layers Panel, then click on **Properties**. This should automatically take you to the **Style** panel and there you can change the color, transparency, etc. You will notice some example symbols and colors on the right side of the Style panel. Click on land. Click **Apply** at the bottom. You will see the fill change colors. Click **OK**.




- Repeat the previous steps to add the CA_Cities_Top10.shp and Yosemite_boundary.shp files. These are a point file of the ten largest cities in California based on population, and the boundary of Yosemite National Park.
- Right click on the CA_Cities_Top10 file in the Layers Panel, then click on **Properties**. In the **Style** tab, change the symbol to the city option in the box on the right. Then, using the dropdown menu next to **Color**, change the fill color to blue.
- You can also add labels to a map and modify them based on your specific cartographic needs. Click on the **Labels** tab. In the top drop down menu choose **Show Labels for this Layer**. In the drop down menu next to **Label With** select NAMELSAD. Click Apply.


- Without closing the Properties box, take a look at the city labels in the map. You can also change the formatting of the labels. Click on the **Buffer** option within the **Labels** tab. Check the **Draw text buffer** button and keep everything as default. Click on the **Shadow** option and check the Draw drop shadow. Finally, click on the **Placement** option and increase the distance to 1 millimeter by clicking on the “up” arrow next to **Distance**. Click **Apply** again and close the **Properties** window. Take a look at the labels again in the map. They are now a bit easier to read.



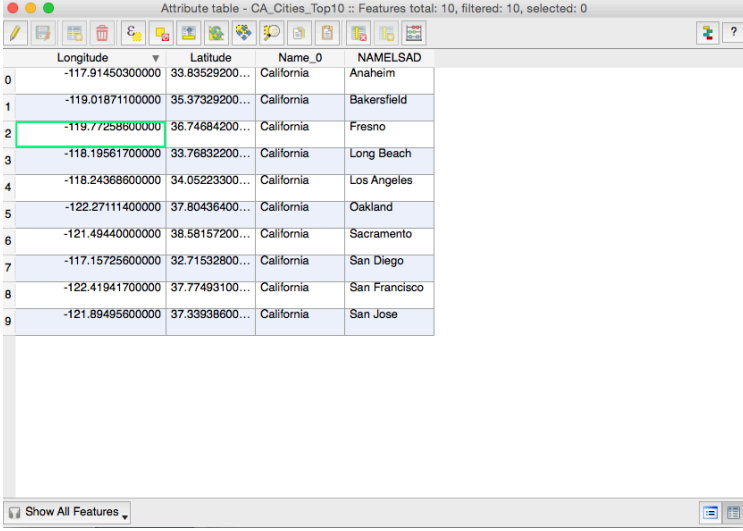
- You can also modify and label the Yosemite layer in the same way. Open the Properties box and change the color to dark green. Click on **Simple Fill** in the fill box on the left side. Then change the Fill color to green and the Boarder to red.
- Label the layer using the **UNIT_NAME** and give it a white **Buffer** of 0.7 millimeters.

Viewing data and Vector Attributes

- Using some of the tools on the top of your QGIS project panel, you can modify the view of your data. Click on the **Zoom Full**  tool. This should display the full extent of all of your map layers. You can also zoom into specific layers. Click on the Yosemite_boundary layer, then click on the **Zoom to**

Layer  tool. This should allow you to view the full extent of the Yosemite NPS boundary. You can also zoom to a specific layer by right clicking on the layer in the Layers Panel and clicking on Zoom to Layer.

- You can also obtain more information about the specifics of a vector layer by taking a look at the Attribute table. Right click on the CA_Cities_Top10 layer and click on **Open Attribute Table**. Here you will see the latitude and longitude of each point, the state, and the city name.



	Longitude	Latitude	Name_0	NAMELSD
0	-117.914503000000	33.83529200...	California	Anaheim
1	-119.018711000000	35.37329200...	California	Bakersfield
2	-119.772586000000	36.74684200...	California	Fresno
3	-118.195617000000	33.76832200...	California	Long Beach
4	-118.243686000000	34.05223300...	California	Los Angeles
5	-122.271114000000	37.80436400...	California	Oakland
6	-121.494400000000	38.58157200...	California	Sacramento
7	-117.157256000000	32.71532800...	California	San Diego
8	-122.419417000000	37.77493100...	California	San Francisco
9	-121.894956000000	37.33938600...	California	San Jose

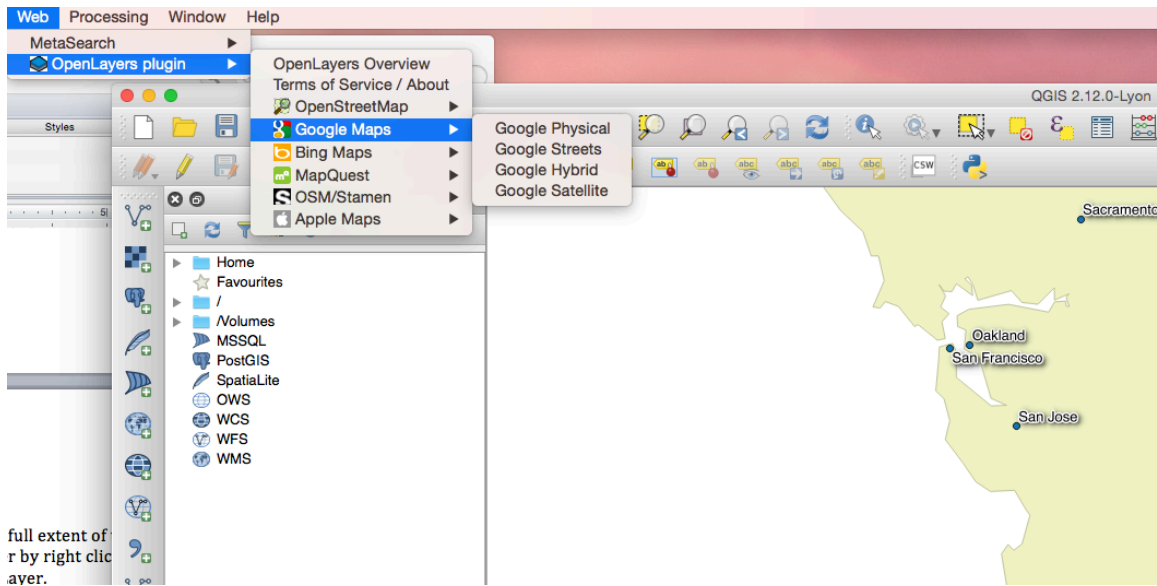
Saving your QGIS Projects

- It is also very important to save your QGIS projects along the way so that you do not lose any important processing steps. At the top of your screen click on **Project**, then **Save As**. Navigate to your data folder for this webinar and save the project as Week1 or something similar. We recommend that throughout this exercise and your homework assignments, that you regularly

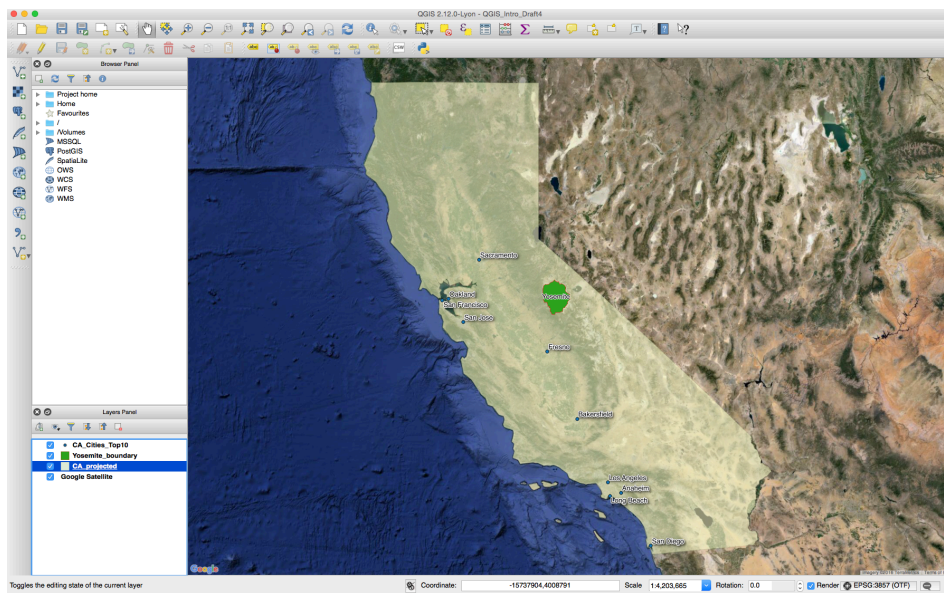
click on the **Save** icon .

Using Plugins

- You can also add some background imagery to your map using the OpenLayers Plugin. At the top of your screen click on Web, then **OpenLayers Plugin**, then **Google Maps**, and **Google Satellite**. It may take some time to load in your map, so be patient! Then zoom to your CA_Projected layer.



- Move the Google Satellite layer to the bottom of the Layers Panel by clicking on Google Satellite and dragging it down below the other layers.
- You can then adjust the transparency of the California layer. Right click on the CA_Projected layer and go to **Properties**. In the **Style** tab under **Layer rendering** you can adjust the **Layer transparency** by sliding the circle to the right or typing in a specific transparency on the box on the right. Adjust the transparency to 40. Click **Apply** then click **OK**. Now you can see some of the earth features under the California layer.



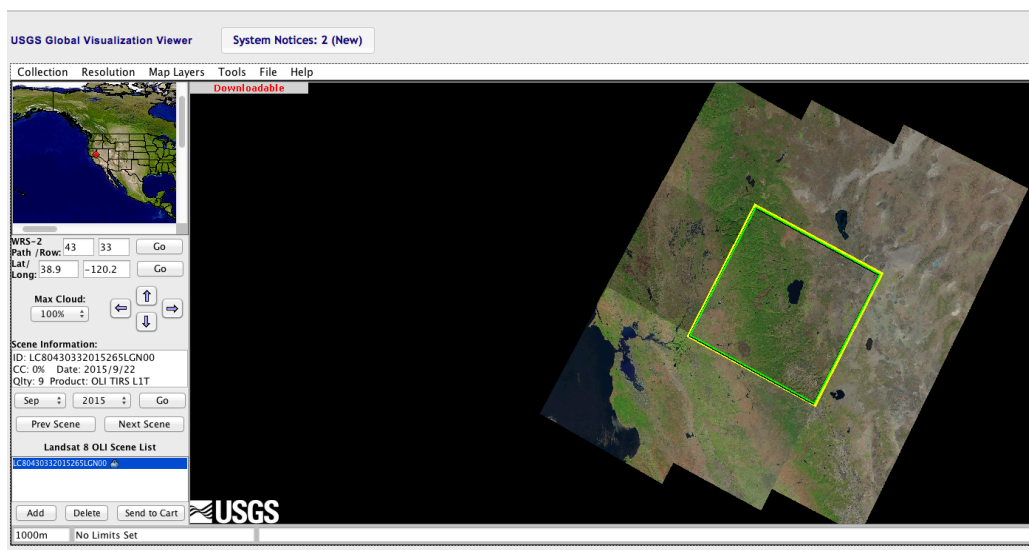
- As you may have noticed, the Google Satellite layer causes QGIS to run quite slow and can sometimes cause it to freeze. Here is where that regular saving

comes in handy! So if you are creating a map it is recommended that you add this layer at the very end of your work. Right click on the Google Satellite layer and click on **Remove**.

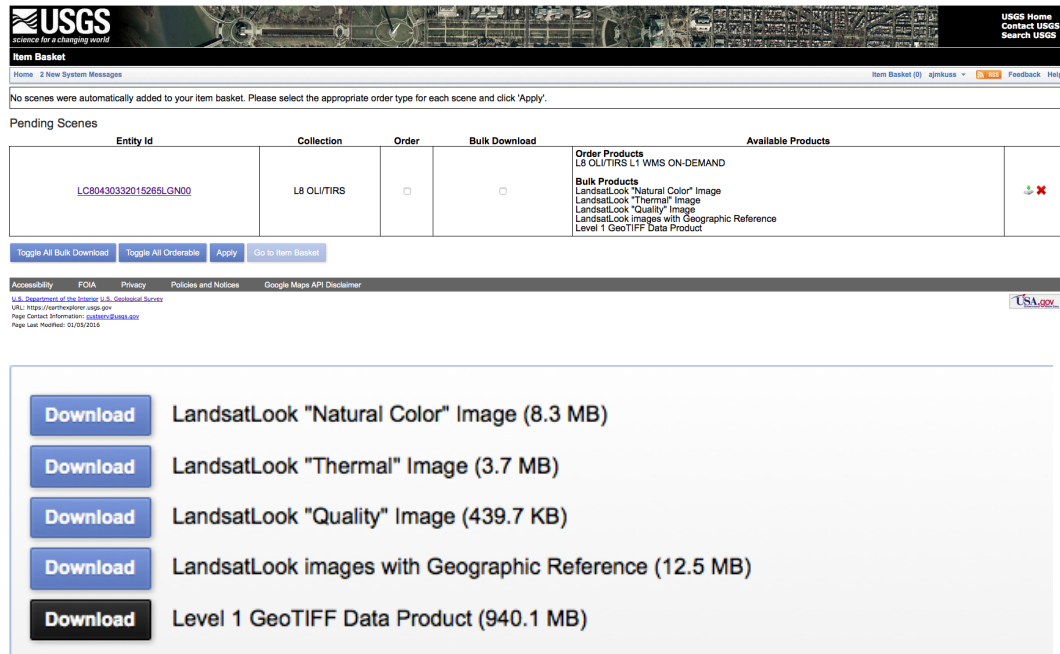
Part 4: Downloading Raster Data

For this portion of the exercise we will be downloading and viewing a raster layer. We will step through the process of downloading a Landsat image. This image will also be used in additional exercises and homework assignments.

- Go to the USGS Global Visualization Viewer (GloVis) website here: <http://glovis.usgs.gov/>. If you do not have an account, you must register by clicking on **Register** in the top right. This is free and easy to do by creating a username and password. Once you are registered you will receive an email to confirm your account. If you have an account, login now. Once you login, you should see your username on the top right corner of the webpage.
- Click on the **Collection** tab, scroll down to **Landsat Archive**, then select **Landsat 8 OLI**. Under the small image on the left, next to WRS-2 Path/Row type in 43 and 33 (path 43, row 33) then click **Go**.
- Under the Scene information change the date to September 2015 then click **Go**. You should see the scene we want highlighted in yellow in the preview pane on the right. At the bottom of the webpage under Landsat 8 OLI Scene list click **Add**. Then click **Send to Cart**.



- A separate tab will open up that is your cart. This is like your shopping cart. You will see the Entity ID listed. Click on the ID **LC80430332015265LGN00**. This will take you to another webpage that shows a preview of the image and information. Scroll down to the bottom of the page and click on **Download**. Then click on the last **Download** button next to Level 1 GeoTIFF Data Product (940.1 MB).



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LC80430332015265LGN00	L8OLI/TIRS	<input type="checkbox"/>	<input type="checkbox"/>	Order Products L8OLI/TIRS L1 WMS ON-DEMAND Bulk Products LandsatLook "Natural Color" Image LandsatLook "Thermal" Image LandsatLook "Quality" Image LandsatLook images with Geographic Reference Level 1 GeoTIFF Data Product

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Download LandsatLook "Quality" Image (439.7 KB)

Download LandsatLook images with Geographic Reference (12.5 MB)

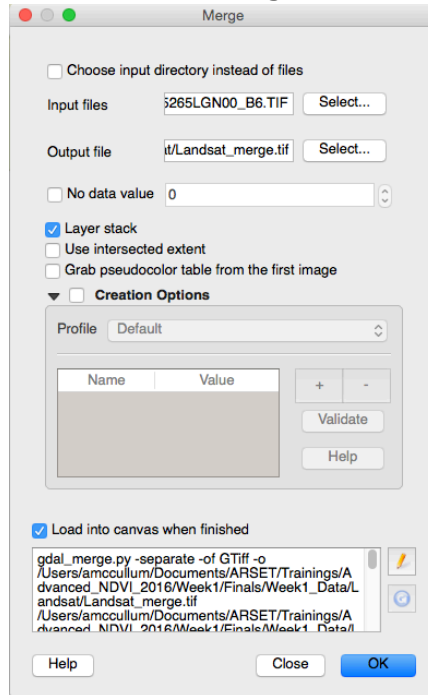
Download Level 1 GeoTIFF Data Product (940.1 MB)

- The image will take a while to download depending on your connection. In my case, the file took about 25 minutes to download.
- Once the file has downloaded, you will receive the file as a .tar.gz file. For most Mac users, this will require using the Archive Utility application. This should be invoked automatically with OS X Yosemite. For Windows users, you can use 7-zip (<http://www.7-zip.org/>). Here is a nice tutorial on how to download and install 7zip and how to extract files from a .tar file: <https://www.youtube.com/watch?v=QlJbXUkM1Us>. Please make sure you have the ability to unzip these files.
- Once you have downloaded and unzipped the Landsat images, save the folder with your other files for this webinar. Take a look at the files. You will notice that they named using the standard Landsat naming convention, and that there are separate files for each band (e.g. B1, B2, B3).

Adding Raster Images

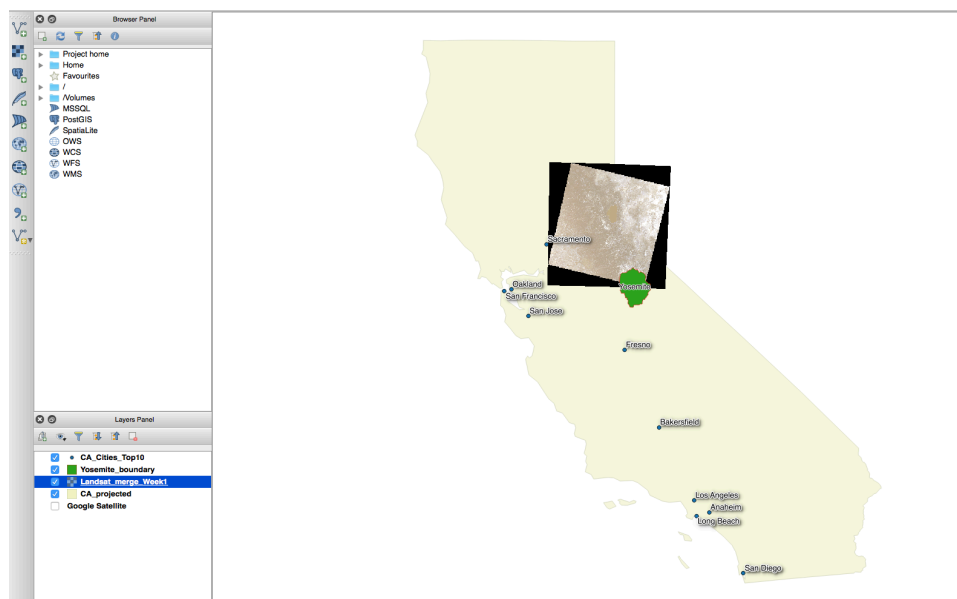
- At the top of your screen, Go to **Raster/Miscellaneous/Merge**

- In the Merge dialog box, click the **Select** button next to **Input files**. Navigate to the directory where your Landsat 8 imagery is located. Select bands 1 through 6. Click on the **Select** button next to **Output File**. Navigate to your data folder and call the file Landsat_merge. Check the box next to **Layer**



Stack and make sure the **Load into canvas when fished** box is checked. Click **OK**. Once processing is complete, you will see them appear next to Input files.

The raster should then be added to the map. However, you may notice that the colors do not look very vibrant. We will address this and many other raster-related processing steps during week 2.






- Make sure to **Save** your QGIS project! The steps in this exercise will be helpful for your homework and for week 2.
- As a final step before you quit QGIS, at the top of your computer, Click on **Project**, then **Project Properties**. Under the General Settings make sure that next to **Save paths** it says **Relative**. This should be the default setting for QGIS, but it is important to check. Relative paths specify the location of the data contained in the map relative to the current location. This means that you should be able to move all the files and the QGIS project to a different folder or computer. However, it is recommended for this tutorial to keep all data in the same location.

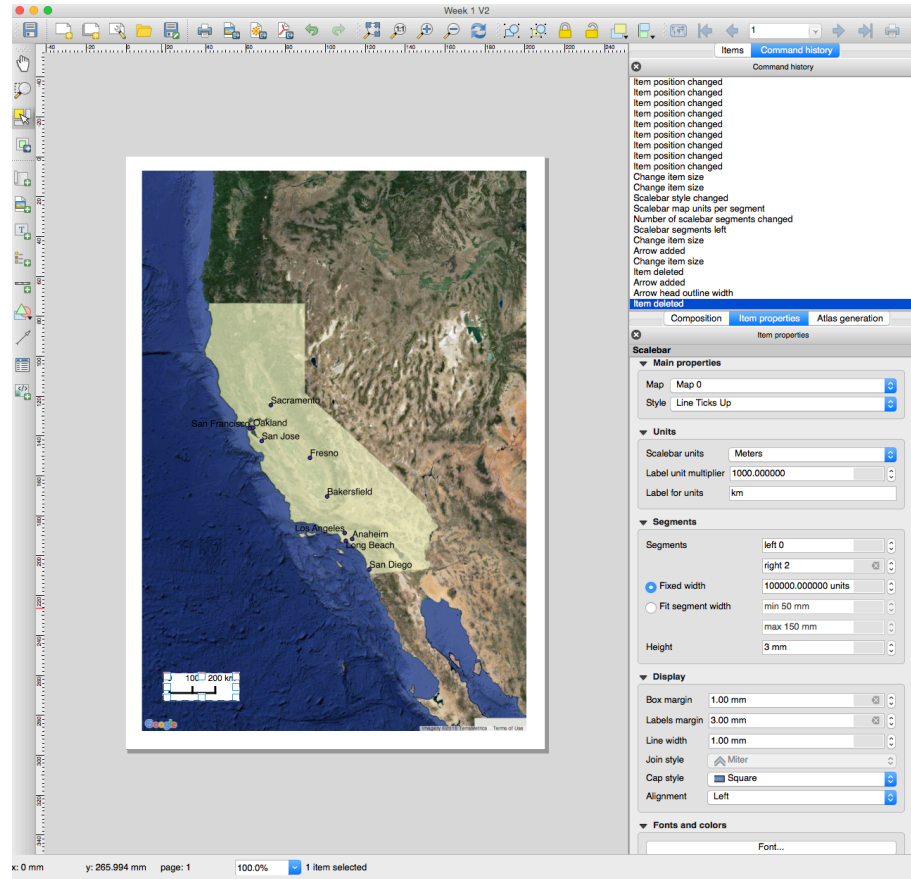
Next week we will learn how to modify rasters and generate an NDVI image.

Additional Optional Exercise: Creating a Map with Print Composer

The **Print Composer** function allows you to create a map as a pdf or an image file. You can add all the “pieces” of a map such as adding a legend, scale bar, north arrow, etc. Once you create your first map, you can also save the map template for quick map-making in the future. Let’s briefly explore this tool.

- Turn off the raster layer by unchecking the layer in the **Layers Panel**.
- At the top of your screen click on Web, then **OpenLayers Plugin**, then **Google Maps**, and **Google Satellite**. It may take some time to load in your map, so be patient! Then zoom to your CA_Projected layer.
- At the top of your screen, click on **Project**, then **New Print Composer**. In the name prompt, type Week 1 Map.
- A new window will appear. Under **Page size** on the right side, change the **Orientation** to **Portrait**.
- On the left hand side of the **Print Composer**, click on **Add new map** . Then hover over the blank page and draw a rectangle about the size of your page. This will automatically display your project properties within the new map.
- If California is not centered, click on Move item content . Then click on the map to move around the contents.
- Click on **Add scalebar** . Then click on the lower left side of the map. The scale bar will automatically be displayed. On the right side panel click on

Item properties. In the **Style** option under **Main properties**, choose **Line Ticks Up**. Under **Segments**, decrease the left to 0 and the right to 2. Under **Fonts and colors**, change the fill color to white by clicking on the triangle next to the color box and choosing white. Under **Background**, change the background color to white.



You can then check out all the other features of the **Print Composer**. You can style your maps to fit your cartographic needs. To end this homework we will save the map as a pdf.

- At the top of your screen, click on **Composer**, then **Export As PDF**. A screen may pop up saying that it is recommended to print as raster, if so, click OK. This will still have the map as a pdf. Navigate to your webinar folder, name your map *Week 1 Map*, and click **Save**. You can then open this file and take a look at the map you created.

For additional fun with Print Composer, here are some helpful websites:

http://docs.qgis.org/1.8/en/docs/user_manual/print_composer/print_composer.html and http://www.qgistutorials.com/en/docs/making_a_map.html